

L-TRONICS DF

The L-Tronics LA series Aircraft Direction Finder, the most common DR unit found in CAP aircraft, consists of VHF and UHF receivers, two- or three-element yagi antennas and circuitry. The controls consist of a frequency selector switch, an alarm toggle switch (works like a light switch), and a dual-knob control switch for volume (inner knob) and sensitivity (outer knob). There are two indications: a DF meter and a signal Strength meter (refer to Figure 10-3).



Figure 10-3

The tone-coded squelch circuit, called the Alarm mode, permits continuous, annoyance-free monitoring for Emergency Locator Transmitters (ELTs) and Emergency Position Indicating Radio Beacons (EPIRBs) on 121.5 MHz.

The DF unit is normally connected to the aircraft audio system. This connection allows an audible as well as a visual alarm when an ELT signal is detected in ALARM mode.

The three-whip antenna array provides for dual band operation. The performance of the DF is absolutely dependent on the antenna installation. The whip antennas and the aircraft structure work together to form the directive antenna patterns necessary to the operation of the DF set.

There is considerable interaction between DF and communications antennas. The DF switching may put a strong tone on communications receiver signals from some directions. The DF may have to be turned off or the aircraft heading changed for good communications intelligibility. In particular, the DF receiver may cause interference to communications on 132.3 MHz when operating on 121.5 MHz (126.85 MHz when using 243.0 MHz).

Normal Operations and Checks

The Alarm mode is the normal mode for routine conditions. It enables the pilot to monitor the emergency frequency (121.5 MHz) without dedicating a communications radio to the task. **DO NOT USE THIS MODE DURING A DF SEARCH** because the DF function is disabled in the Alarm mode.

To select the Alarm mode, place the Alarm toggle switch to the on (up) position. Set the SENSitivity so that the needle just comes on-scale and the VOLume to a comfortable level (the ear will detect a weak signal far sooner than the alarm). [Note: The Alarm mode is designed to work with weak signals; if an ELT is transmitting nearby and the unit is set to full sensitivity, the receiver may overload.]

If an ELT activates the Alarm, turn the Alarm toggle switch off (down). This activates the DF function and allows you to track the signal.

The alarm unit automatically rejects false signals. The ELT signal must remain at sufficient strength for 5-20 seconds before the alarm light (flashing red LED) is activated.

Functional Check - No transmitter

This is a quick check that can be made part of a preflight routine to assure that a previously checked unit is still working:

1. Select 121.5 MHz on the DF.
2. Turn the Alarm toggle switch off (down).
3. Turn the SENSitivity control (outer knob) fully clockwise to maximum.
4. Turn on power to the radio system.
5. Turn on the DF by advancing the VOLume control (inner knob).
6. A hissing sound should be heard through the audio system and the signal strength needle will be between $\frac{1}{4}$ and $\frac{1}{2}$ of the way between the center of the scale and the left-hand end. The DF needle will stay roughly centered.

7. Now turn the SENSitivity control counterclockwise toward minimum. This will cause a decrease in sound volume (some sound may still be heard) and a decrease in the strength meter reading.
8. Next, turn the SENSitivity control to maximum. The DF needle should move randomly back and forth one or two needle-widths about the center in response to receiver background noise. *Movement will be slow and may be difficult or impossible to see.*
9. As a final check, turn the Alarm toggle switch to on (up). The Alarm light should flash for 10 to 20 seconds and then stop. The receiver noise should also cut off at the same time. The Alarm is now set and will respond to a steady ELT signal. *[NOTE: This Alarm setting period occurs each time the Alarm function of the DF is turned on. It tests the Alarm circuits and reminds the pilot that the DF receiver is on.]*

Functional Check - with transmitter and the aircraft on the ground

All features of the DF except the Alarm circuit can be checked using a signal generator or a transmitter on 121.775 MHz (e.g., a practice ELT, a portable transceiver, or another aircraft's radio).

1. Park the aircraft in the open, away from metal buildings. The transmitter should be at least 50 feet in front of and 15-30 degrees to one side of the aircraft.

WARNING: Use of high-power transmitters close to the DF antennae can damage the unit. Damage can occur from a 50-watt transmitter if it is within 12 feet of the antennae (3 feet for 5W; 4 1/2 feet for 10W; 15 feet for 80W). The ELT tester should be kept at least 50 feet away from the antennae when using to test for operability of the DF.
2. Select 121.775 MHz on the DF.
3. Rotate the SENSitivity control fully counterclockwise to minimum.
4. Set the VOLume control to about the 12 o'clock position.
5. Set the Alarm toggle switch off (down).
6. Turn on the DF and the transmitter. If necessary, rotate the SENSitivity control clockwise until the signal or the DF buzz is heard.
7. The DF needle should point toward the transmitter. Move the transmitter to the other side of the aircraft and observe the DF needle, which should follow the transmitter. NOTE: On the ground it is normal for the needle to be uncertain about centering with the test transmitter directly fore or aft. The DF is OK if the needle points correctly when the transmitter is on either side of the aircraft.
8. Move the SENSitivity control clockwise. The strength needle will move (slowly) further to the right.

Functional Check - with transmitter and the aircraft in flight

Place the test transmitter as high and clear as possible in open terrain. Fly about three to five miles away at 2000 to 3000 feet AGL. Make several full circles, starting with no more than a 10° bank angle. The DF needle should crossover only twice during the turn at shallow bank. More than two crossings indicate unsatisfactory operation.

Pilots and observers should note how the DF performs at steeper bank angles for future reference. Note also where wing shadows occur, as indicated by decreases in the strength meter reading and/or audio volume during steep turns. This is a useful verification of DF indications.

Determine the direction to the ELT by turning in the direction of DF needle deflection. With the needle centered, follow the DF course inbound and compare it to the visual heading to the target transmitter. The inbound course and the heading to the transmitter should agree to +/- 5°; up to +/- 15° error is quite usable. If desired, you can note the error on a placard near the DF receiver.

Finally, compare the inbound and the outbound courses using the DG (heading indicator). They should differ by 180°.

Course errors of up to 30° are usually due to unsymmetrical installation of the antennas or, on the ground, to nearby reflecting objects (e.g., cars or buildings). Asymmetry usually causes both front and rear courses to be bent toward the same side of the aircraft and usually toward the source of the problem.

Severe errors or one-sided needle indications are usually due to a damaged antenna-to-switchbox cable or to poor grounding at the antenna or a skin joint nearby. Poor skin joint contact may well indicate structurally significant corrosion and should be investigated by a mechanic.

[NOTE: L-Tronics technical support can be reached at 805-967-4859]